HEAD-MOUNTED DISPLAY APPARATUS FOR RETAINING A PORTABLE ELECTRONIC DEVICE WITH DISPLAY

This application is a continuation of patent application Ser. No. 15/274,901, filed Sep. 23, 2016, which is a continuation of patent application Ser. No. 15/246,340, filed Aug. 24, 2016, which is a continuation of patent application Ser. No. 15/215,122, filed Jul. 20, 2016, which is a continuation of patent application Ser. No. 14/862,036, filed Sep. 22, 2015, which is a division of patent application Ser. No. 14/604,059, filed Jan. 23, 2015, which is a continuation of patent application Ser. No. 12/242,911, filed Sep. 30, 2008, which are hereby incorporated by reference herein in their entireties. This application claims the benefit of and claims priority to patent application Ser. No. 15/274,901, filed Sep. 23, 2016, patent application Ser. No. 15/246,340, filed Aug. 24, 2016, patent application Ser. No. 15/215,122, filed Jul. 20, 2016, patent application Ser. No. 14/862,036, filed Sep. 22, 2015, patent application Ser. No. 14/604,059, filed Jan. 23, 2015, and patent application Ser. No. 12/242,911, filed Sep. 30, 2008.

BACKGROUND OF THE INVENTION

This invention is directed to a head-mounted device constructed to receive a portable electronic device having a screen.

Using head-mounted devices, a user may view media provided by a portable electronic device. For example, a user may couple a personal electronic device, such as the iPod™ available from Apple Inc. of Cupertino, Calif., or the iPhone™ also available from Apple Inc. of Cupertino, Calif., to the head-mounted device via a cable or wire. Such a configuration can allow the user to view media on a private display, while the media is provided by a personal handheld device.

Sometimes, however, a wired connection may be inconvenient and cumbersome for the user in certain situations (e.g., the user must separately hold multiple devices and deal with cables).

In addition to being unwieldy, the coupled system often utilizes redundant features, which are not necessary when using the devices together. By way of example, each device utilizes a display screen, which adds cost, size, weight, and complexity to the entire system.

Accordingly, there is a need for an improved head-mounted display system, particularly a system that temporarily integrates or merges both mechanically and electronically a head-mounted device with a portable electronic device.

SUMMARY OF THE INVENTION

In accordance with the invention, a head-mounted display system and method of operation are provided in which the system can allow users to couple and decouple a portable electronic device with a head-mounted device. The portable electronic device may for example be physically and/or operatively coupled and decoupled with the head-mounted device. In some embodiments, the two devices may be considered temporarily integrated.

In accordance with one embodiment of the invention, there is provided a head-mounted device that is worn on a user's head. The head-mounted device may include a frame that is configured to physically receive and carry a portable electronic device. The frame may place a display screen of the portable electronic device in front of the user's eyes. The display screen of the portable electronic device may act as the primary display screen of the head-mounted device such that the display screen of the portable electronic device is primarily used to view image based content when the head-mounted display device is worn on the user's head.

In accordance with another embodiment of the invention, there is provided a method of controlling a portable electronic device having a screen capable of presenting image based content, wherein the portable electronic device presents the image based content in a normal viewing mode that substantially fills the screen during normal use of the portable electronic device. The method may include detecting a connection with a head-mounted device that is capable of being worn on a user's head, wherein the connection indicates that the portable electronic device is operatively coupled and physically carried by the head-mounted device. The method may also include switching to a head-mounted mode on the screen of the portable electronic device.

In accordance with yet another embodiment of the invention, there is provided a method for displaying image based content on a head-mounted device. The method may include coupling a portable electronic device to the head-mounted device such that a screen of the portable electronic device faces a user. The method may also include providing an instruction to play back image based content stored on the portable electronic device, wherein the image based content is displayed on the screen of the portable electronic device. The method may also include adjusting the image based content displayed on the screen for close up viewing.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features of the present invention, its nature and various advantages will be more apparent upon consideration of the following detailed description, taken in conjunction with the accompanying drawings in which:

FIG. **1** shows a simplified diagram of a head-mounted display system in accordance with embodiments of the invention;

FIGS. **2**A and **2**B show simplified schematic diagrams of a head-mounted display system in accordance with embodiments of the invention;

FIGS. **3**A-**3**C show perspective views of a head-mounted device in accordance with embodiments of the invention;

FIG. **4** shows an alternative configuration of a head-mounted device in accordance with embodiments of the invention;

FIG. **5** shows a configuration for sliding a portable electronic device into a head-mounted device in accordance with embodiments of the invention;

FIGS. **6**A and **6**B show top views of two exemplary head-mounted display systems in accordance with embodiments of the invention;

FIG. **7** shows a side view of a head-mounted device coupled to a portable electronic device in accordance with embodiments of the invention;

FIGS. **8**A-**8**D show illustrative features for exemplary head-mounted devices in accordance with embodiments of the invention;

FIGS. **9**A-**9**C show a head-mounted device in accordance with embodiments of the invention;

FIGS. **10**A and **10**B shows an exemplary portable electronic device in accordance with embodiments of the invention;